

11.0 EMERGING TECHNOLOGY STUDIES

Prerequisite: Fundamentals of Technology

Emerging/Engineering Technology Studies provides an opportunity for students to research and experiment with a technology-related topic of their choice. Topics may be chosen using the knowledge, skills and insights gained from previous vocational and academic courses, or from the latest information available in professional journals, Internet databases, or professionals in the field. Students work on an individual or small group project under the guidance of a technology teacher with input and involvement from other from other vocational and/or academic teachers and adult mentors. Students investigate technological concepts and apply the tools of technology to better understand other fields of study. The topic of study must be approved by the teacher in accordance with local established guidelines and criteria. Examples of projects might include: extensive research on lasers, fiber topics; biotechnology experiments; production of a multimedia project dealing with an important social issue related to technology; an original technology-related multimedia production.

PROGRAM TASK LISTING EFFECTIVE DATE: June 30, 1995

PROGRAM AREA: Technology Education

PROGRAM TITLE: Emerging Technology Studies

IDAHO CODE NUMBER: TE 1926

- 11.01 Demonstrate the ability to work safely with a variety of technologies.
- 11.02 Demonstrate interpersonal skills as they relate to the workplace.
- 11.03 Identify and apply methods of information acquisition and utilization.
- 11.04 Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities.
- 11.05 Demonstrate and apply design/problem-solving processes.
- 11.06 Express an understanding of technological systems and their complex interrelationships.
- 11.07 Demonstrate the ability to properly identify, organize, plan, and allocate resources.
- 11.08 Discuss individual interests and aptitudes as they relate to a career.
- 11.09 Demonstrate employability skills and habits.

- 11.10 Demonstrate an understanding of entrepreneurship.
- 11.11 Make an informed and meaningful career choice.
- 11.12 Demonstrate and apply principles related to the following energy systems: fluid, thermal, electrical, and mechanical.
- 11.13 Communicate the results of experiments or research through oral, written or multimedia presentations.
- 11.14 Demonstrate graphical literacy and the use of graphical representations in analysis and design.
- 11.15 Describe the legal, social, ethical, and economic factors that influence a technology related topic or engineering design..
- 11.16 Discuss careers and practices related to emerging/engineering technology topics.
- 11.17 Demonstrate research techniques and engineering analysis/design methods.
- 11.18 Demonstrate the engineering design reporting process as a team effort.
- 11.19 Demonstrate and apply mechanical, fluid, electrical and thermal system principles.
- 11.20 Demonstrate knowledge of materials and processes.
- 11.21 Use tools, machines, calculators, and computers necessary for obtaining solutions to design problems.
- 11.22 Describe the functional characteristics of the engineering design team.
- 11.23 Conduct a research, experimentation or design project related to engineering technology.
- 11.24 Contact and interview an expert in the field related to the chosen technology topic.
- 11.25 Utilize current technology to access information related to the chosen technology topic.
- 11.26 Model an idea using appropriate computer simulation software or scale modeling techniques.

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11.01 DEMONSTRATE THE ABILITY TO WORK SAFELY WITH A VARIETY OF TECHNOLOGIES--

The student will be able to:

1. Select appropriate tools, procedures, and/or equipment needed to produce a product.
2. Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
3. Demonstrate knowledge required to maintain and troubleshoot equipment used in a variety of technological systems.
4. Follow laboratory safety rules and procedures.
5. Demonstrate good housekeeping at work station within total laboratory.
6. Identify color-coding safety standards.
7. Explain fire prevention and safety precautions and practices for extinguishing fires.
8. Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.

11.02 DEMONSTRATE INTERPERSONAL SKILLS AS THEY RELATE TO THE WORKPLACE--

The student will be able to:

1. Perform roles in a student personnel system or in the Idaho Technology Student Association (ID-TSA).
2. Participate as a member of a team.
3. Teach others new skills.
4. Identify skills needed to serve clients/customers.
5. Demonstrate leadership skills.
6. Describe strategies necessary for negotiating agreements.
7. Demonstrate the application of skills necessary to work with people of diverse backgrounds.
8. Form an understanding and appreciation for work after listening to or observing technology workers.
9. Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
10. Form an understanding and appreciation for the roles and work of co-

workers.

11.03 IDENTIFY AND APPLY METHODS OF INFORMATION ACQUISITION AND UTILIZATION--

The student will be able to:

1. Define terms related to computers.
2. Identify and describe methods of information acquisition and evaluation.
3. Discuss advantages and disadvantages in the application of technologies.
4. Produce a plan to organize and maintain information relevant to emerging technologies.
5. Comprehend and communicate information relevant to emerging technologies.
6. Demonstrate the use of computers to process information.

11.04 APPLY BASIC SKILLS IN COMMUNICATIONS, MATHEMATICS, AND SCIENCE APPROPRIATE TO TECHNOLOGICAL CONTENT AND LEARNING ACTIVITIES--

The student will be able to:

1. Identify and explain the main and subordinate ideas in a written work.
2. Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
3. Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
4. Distinguish fact from opinion.
5. Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
6. Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
7. Improve one's own writing by restructuring, correcting errors, and rewriting.
8. Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.
9. Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
10. Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
11. Compose unified and coherent correspondence, directions, descriptions, explanations and reports.
12. Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
13. Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.

14. Use the mathematics of:
 - integers, fractions, and decimals;
 - ratios, proportions, and percentages;
 - roots and powers;
 - algebra;
 - geometry.
15. Make estimates and approximations, and judge the reasonableness of a result.
16. Use elementary concepts of probability and statistics.
17. Draw, read, and analyze graphs, charts, and tables.
18. Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and field work.
19. Organize and communicate the results obtained by observation and experimentation.
20. Apply the basic principles of biology, physics, and chemistry (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
21. Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, trouble shooting problems on a machine).

11.05 DEMONSTRATE AND APPLY DESIGN/PROBLEM-SOLVING PROCESSES--

The student will be able to:

1. Describe and explain steps in the design/problem-solving process.
2. Propose solutions to given problems.
3. Design and implement the optimal solution to a given problem.
4. Document each step of the design/problem-solving process.
5. Demonstrate "Brainstorming" as a process to solve problems.
6. Define "critical thinking" and its value in the problem-solving process.

11.06 EXPRESS AN UNDERSTANDING OF TECHNOLOGICAL SYSTEMS AND THEIR COMPLEX INTERRELATIONSHIPS--

The student will be able to:

1. Demonstrate knowledge of how social, organizational, and technological systems work.
2. Explore methods used to monitor and correct performance of technological systems.
3. Design and implement an optimal solution to a given problem.
4. Outline major historical technological developments or events.
5. Identify recent advances in technology.
6. Explain problem-solving roles of technology.

7. Forecast a technological development or event.
8. Define technology.

11.07 DEMONSTRATE THE ABILITY TO PROPERLY IDENTIFY, ORGANIZE, PLAN, AND ALLOCATE RESOURCES--

The student will be able to:

1. Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
2. Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
3. Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
4. Display knowledge of the efficient use of human resources.

11.08 DISCUSS INDIVIDUAL INTERESTS AND APTITUDES AS THEY RELATE TO A CAREER--

The student will be able to:

1. Describe individual strengths and weaknesses.
2. Discuss individual interests related to a career.
3. Identify careers within specific areas of technology.
4. Explore careers within specific areas of interest.

11.09 DEMONSTRATE EMPLOYABILITY SKILLS AND HABITS--

The student will be able to:

1. Identify employment opportunities.
2. Apply employment seeking skills.
3. Interpret employment capabilities.
4. Demonstrate appropriate work behavior.
5. Maintain safe and healthy environment.
6. Maintain businesslike image.
7. Maintain working relationships with others.
8. Communicate on the job.
9. Adapt to change.
10. Demonstrate knowledge of manufacturing.
11. Perform mathematical calculations.
12. Compile a portfolio.

11.10 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP--

The student will be able to:

1. Define entrepreneurship.
2. Describe the importance of entrepreneurship to the American economy.

3. List the advantages and disadvantages of business ownership.
4. Identify the risks involved in ownership of a business.
5. Identify the necessary personal characteristics of a successful entrepreneur.
6. Identify the business skills needed to operate a small business efficiently and effectively.

11.11 MAKE AN INFORMED AND MEANINGFUL CAREER CHOICE--

The student will be able to:

1. Make a tentative occupational choice based on the information learned and interest developed in this course.
2. Review tentative occupational choices based on the information learned and interest developed in this course.

11.12 DEMONSTRATE AND APPLY PRINCIPLES RELATED TO THE FOLLOWING ENERGY SYSTEMS: FLUID, THERMAL, ELECTRICAL, AND MECHANICAL--

The student will be able to:

1. Assemble, operate, and identify the parts of a system which demonstrates fluid system principles.
2. Demonstrate and apply principles of force, work, rate, resistance, energy, power, and force transformers relating to fluid systems.
3. Assemble, operate, and identify the parts of a system which demonstrates thermal system principles.
4. Demonstrate and apply principles of force, work, rate, resistance, energy, power, and force transformers relating to thermal systems.
5. Assemble, operate, and identify the parts of a system which demonstrates electrical system principles.
6. Demonstrate and apply principles of force, work, rate, resistance, energy, power, and force transformers relating to electrical systems.
7. Assemble, operate, and identify the parts of a system which demonstrates mechanical systems principles.
8. Demonstrate and apply principles of force, work, rate, resistance, energy, power, and force transformers relating to mechanical systems.

11.13 COMMUNICATE THE RESULTS OF EXPERIMENTS THROUGH RESEARCH, WRITTEN OR MULTIMEDIA PRESENTATIONS--

The student will be able to:

1. Understand and interpret basic engineering drawings.
2. Measure quantities and conduct basic tests according to published procedures.
3. Use precision measuring tools and instruments to layout, measure and inspect parts or articles.

4. Sketch objects using multi-view and pictorial principles.
5. Prepare drawings using basic technical drawing instruments for orthographic and isometric projections.
6. Use engineering design graphics and descriptive geometry in the solution of design problems.
7. Describe graphic communications principles.
8. Use current multimedia authoring software and hardware to produce a multimedia presentation of the project.

11.14 DEMONSTRATE GRAPHICAL LITERACY AND THE USE OF GRAPHICAL REPRESENTATIONS IN ANALYSIS AND DESIGN--

The student will be able to:

1. Identify the basic tools and instruments for engineering design graphics.
2. Express knowledge and basic theory in engineering design graphics.
3. Make a technological decision related to engineering design graphics.
4. Interpret engineering design graphics, using various systems of measurement.
5. Define and outline steps in the engineering design graphics process.
6. Describe the use of sketches and assembly drawings in the engineering design process.
7. Use engineering design graphics to describe the solution of an engineering problem.

11.15 DESCRIBE THE LEGAL, SOCIAL, ETHICAL, AND ECONOMIC FACTORS THAT INFLUENCE A TECHNOLOGY RELATED TOPIC OR ENGINEERING DESIGN--

The student will be able to:

1. Discuss the legal constraints placed on the practice of engineering.
2. Discuss the underlying principles of professional ethics.
3. Discuss the underlying principles of business (i.e., industrial) ethics.
4. Describe how economics and resource availability can influence design.
5. Explain the need and use of design standards.
6. Describe the legal protection afforded an inventor or designer.

11.16 DISCUSS CAREERS AND PRACTICES RELATED TO EMERGING/ENGINEERING TECHNOLOGY TOPICS--

The student will be able to:

1. Summarize the professional characteristics of engineers.
2. List the principal fields for specialization in engineering.
3. Describe the procedures for becoming a registered engineer in Idaho.
4. Describe the procedures for becoming a certified engineering technician.
5. Outline the typical steps to follow to prepare for a course of study leading to an engineering career.

11.17 DEMONSTRATE RESEARCH TECHNIQUES AND ENGINEERING ANALYSIS/DESIGN METHODS--

The student will be able to:

1. Define the terms: analysis, design, and application.
2. Define the experimental method as it is applied to design.
3. Describe methodology.
4. Describe simulation.
5. Prepare a model of a design solution to an engineering problem.
6. Prepare a graphical solution to an engineering problem.
7. Prepare a mathematical solution to an engineering problem (using either a calculator or computer).

11.18 DEMONSTRATE THE ENGINEERING DESIGN REPORTING PROCESS AS A TEAM EFFORT--

The student will be able to:

1. Research an engineering achievement and prepare a model, or display.
2. Deliver a short oral briefing which explains a technical device, process or achievement.
3. As a team, present a technical report on an engineering design problem, concept or issue.

11.19 DEMONSTRATE AND APPLY MECHANICAL, FLUID, ELECTRICAL AND

THERMAL SYSTEM PRINCIPLES--

The student will be able to:

1. Demonstrate the design solution to a mechanical system problem.
2. Demonstrate the design solution to a fluid system problem.
3. Demonstrate the design solution to an electrical system problem.
4. Demonstrate the design solution to a thermal system problem.
5. Select materials and processes to satisfy specific design criteria.
6. Select a problem or product for improvement using the design methodology.

11.20 DEMONSTRATE A KNOWLEDGE OF MATERIALS AND PROCESSES--

The student will be able to:

1. Describe the physical and chemical properties of engineering materials in terms of their structure.
2. List the causes of failure in materials and give procedures to prevent such failure.
3. Experiment with processes used with metal, woods, polymers, composite materials and adhesives.

11.21 USE TOOLS, MACHINES, CALCULATORS, AND COMPUTERS NECESSARY FOR OBTAINING SOLUTIONS TO DESIGN PROBLEMS--

The student will be able to:

1. Demonstrate the use of various graphs to categorize and display data.
2. Make decisions using graphical data presentations.
3. Demonstrate the use of a nomograph in solving equations.
4. Use a numerical calculator to solve complex equations either by direct solution or iteration (trial and error).
5. Use a computer and applications software to solve a design problem by simulation.
6. Demonstrate graphical vector analysis.

11.22 DESCRIBE THE FUNCTIONAL CHARACTERISTICS OF THE ENGINEERING DESIGN TEAM--

The student will be able to:

1. Describe work breakdown organization.
2. Describe work group organization schemes including functional and hierarchical schemes.
3. Describe the function of management in general and project management in particular.
4. Describe a typical design project team structure.
5. Outline a research methodology.
6. Describe brain-storming.

11.23 CONDUCT A RESEARCH, EXPERIMENTATION OR DESIGN PROJECT RELATED TO ENGINEERING TECHNOLOGY--

The student will be able to:

1. Choose appropriate research materials such as professional journals, magazines, reference books, CD-ROM, or Internet databases to determine a unique research topic.
2. Gather and evaluate research data with regard to the design of a technology-related project.
3. Synthesize research data into an experiment plan.
4. Conduct an experiment related to the technology topic.

11.24 CONTACT AND INTERVIEW AN EXPERT IN THE FIELD RELATED TO THE CHOSEN TECHNOLOGY TOPIC--

The student will be able to:

1. Locate and interview experts in the field of research using sources such as the Thomas Register, local business and industry, advisory committee members.
2. Conduct an Internet search to find an expert in the field of study.
3. Invite local experts to present to the class

11.25 UTILIZE CURRENT TECHNOLOGY TO ACCESS INFORMATION RELATED TO THE CHOSEN TECHNOLOGY TOPIC--

The student will be able to:

1. Utilize CD-ROM, laser disk, telecommunication, or other sources to research technology-related topics.
2. Contact and interview university-level experts in the field of research.

11.26 MODEL AN IDEA USING APPROPRIATE COMPUTER SIMULATION SOFTWARE OR SCALE MODELING TECHNIQUES--

The student will be able to:

1. Identify a technology-related problem.
2. Research the problem using print and electronic search methods.
3. Analyze and evaluate the research data.
4. Synthesize the research data and apply it to the problem.
5. Design and conduct a test or experiment related to the problem.
6. Evaluate the results of the experiment.
7. Reformulate and re-try the experiment based on evaluation.

8. Produce a multimedia presentation about the technology topic.
9. Use appropriate model making techniques and materials to make a working model of the technology topic.
10. Simulate the research topic using computer animation or simulation software.